ACOUSTICS2008/3193
Active sonar discrimination of water-column objects from bottom clutter using waveguide invariant modeling of distributed backscatter

Jeffrey Krolik, Ryan Goldhahn and Granger Hickman
Duke University, ECE Dept. Hudson Hall 130, PO Box 90291, Durham, NC 27708, USA

The ability to differentiate water-column returns from clutter discretes due to backscatter from bottom features is critical to improving the detection performance in active sonar. Previous approaches include the use of statistical feature-based classifiers and physics-based depth estimation. Such methods are typically challenged by the convolutive effect of both uncertain multipath propagation and complex scattering characteristics in sonar returns. In previous work, we used waveguide invariant theory to model frequency-selective fading observed in distributed backscatter from the ocean bottom. In particular, the short-time energy spectrum of backscatter from the sea bottom at a given range can be well estimated along striations in time-frequency energy predicted by waveguide invariant theory. In this paper, we present a statistic which tests the observed frequency-selective fading of the short-time energy spectrum for a range cell under test against the spectrum predicted by waveguide invariant theory for a bottom feature using neighboring ranges and frequency bins. Results are presented for discrimination of a water column target versus bottom clutter using data simulated via a normal mode propagation model with environmental parameters from the Malta Plateau. Receiver operating characteristic analysis is performed showing good discrimination of equal energy targets from clutter.
[Work supported by ONR].